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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/004,152	10/24/2001	Jack A. Mandelman	FIS920010265US1(14912)	8522

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EXAMINER	
BLUM, DAVID S	
ART UNIT	PAPER NUMBER
2813	3

DATE MAILED: 06/05/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/004,152	Applicant(s) MANDELMAN ET AL.	
	Examiner David S Blum	Art Unit 2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-20 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-20 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2 .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Drawings

1. The drawings are objected to because of minor informalities. See form PTO 948. A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1-3, 5-14, and 16-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Verret (US005298450A) in view of Wei (US005950093A).

Verret teaches all of the positive steps of claims 1-3, 5-14, and 16-20 except for forming a plurality of apertures. Verret forms a pad oxide (32) layer on silicon substrate 30, and nitride layer (34) on the oxide layer forming a mask layer. Photoresist 32 is formed on the nitride layer and patterned to expose an area of the substrate. The block mask (photoresist) is removed and a second photoresist is formed and patterned) column 4 lines 1-12). The substrate is etched by reactive-ion etching (RIE, column 4 lines 13-15) to form trench 46. After the first trench etch, the photoresist is removed from selected areas (column 4 lines 30-31 and figure 5) and a second trench is etched by methods

similar to the first etch (thus RIE is suggested). Verret teaches that "trench 46 is preferably etched to a depth somewhat less than eventually desired, as a subsequent etch to be described below is effective to extend the trench deeper into substrate 30" (column 4 lines 26-29). Thus Verret teaches deepening the first trench simultaneously with the formation of the second trench (also see column 4 lines 39-40).

Regarding claims 10 and 11, where a third area is masked an then exposed to form a third set of trenches, this is essentially a repetition of the steps Verret uses to form the second set of trenches. Once the process has been taught, the repetition of the process is obvious. The trenches are filled with deposited isolation material (un-doped polysilicon 62) and planarized (column 5 lines 24-26 and 41-42). Although Verret does not explicitly teach a plurality of each aperture, one would argue that alluding to different isolation trenches for different type circuits suggests a plurality, if not in each circuit then by the plurality of circuits. One skilled in the art would know that a plurality of trenches are formed in a substrate simultaneously.

Wei teaches all of the positive steps of claims 1-20 except for providing a mask stack atop the semiconductor substrate (200) surface prior to forming the first aperture, or that there may be a plurality of (first) apertures. Wei forms the first aperture (alignment mark 202) but is silent as to how the mark is made. One skilled in the art would know to form a patterned mask, exposing the substrate in the area to be etched. Wei then forms a stack of oxide (204) and nitride (206), and a photoresist (column 3 line 1) to define

trench pattern and expose the first aperture. By patterning a deposited photoresist, Wei is performing deposition, lithography, and etching. Wei then etches to form new trenches (208 and figure 2B) and deepen the first aperture. Thus Wei is teaching a plurality of trenches.

One skilled in the requisite art at the time of the invention would modify Verret to include a plurality of apertures as taught by Wei with reasonable expectation of producing trenches with different dimensions (Verret, Wei).

4. Claims 4 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Verret (US005298450A) in view of Wei (US005950093A) as applied to claim 1 above, and further in view of Divakaruni (US006150212A).

Verret and Wei teach all of the positive steps of claims 4 and 15 except for using a hard mask of silicon or boron doped phosphorus glass (BPSG). Divakaruni teaches using a hard mask of TEOS (claim 4) or BSG (20 and 22) on the pad oxide and nitride layers to initially form trenches and then BPSG or BSG as a mask to re-etch the trenches when deepening them.

One skilled in the requisite art at the time of the invention would modify Verret and Wei to include TEOS or BPSG as the hard mask with reasonable expectation of producing trench structures with secondary etching to deepen the profile (Verret, Wei, Divakaruni).

Conclusion

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

US 005893744A Wang Forms deep and shallow trenches using CVD oxide (typically TEOS) as mask

US006207534B1 Chan Forms deep and shallow trenches using CVD oxide (typically TEOS) as mask

US004495025 Haskell Forms deep and shallow trenches using CVD oxide (typically TEOS) as mask

Any inquiry concerning this communication or earlier communications from the examiner should be directed to David S. Blum whose telephone number is (703)-306-9168 and e-mail address is David.blum@USPTO.gov .

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri, can be reached at (703)-306-2794. Our facsimile number for Before-Final Communications is (703)- 308-7722 and for After-Final Communications is (703)- 872-9319. Our receptionist's number is (703)-308-0956.

David S. Blum

May 30, 2002